Will California Ever Get the LED Out? Results from a Fall 2011 LED Market Characterization and Shelf Survey Studies

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ABSTRACT

The purpose of this paper is to provide a high-level assessment of California's light-emitting diode (LED) lamp market characteristics and a snapshot of LED lamp availability, diversity and pricing.

The paper draws primarily on data from 184 lighting retail store shelf surveys conducted during Fall 2011. Field researchers conducted shelf inventories in eight retail store types (discount, drug, grocery, small hardware, lighting & electronics, large home improvement, mass merchandise, and membership clubs) throughout California's three investor-owned utility (IOU) service territories, including 46 surveys from San Diego Gas & Electric, 70 from Pacific Gas & Electric and 68 from Southern California Edison. Researchers collected information on a wide range of screw-base, pin-base, and GU-base lamp types, including details regarding lamp style, base type, manufacturer, model number, special features (such as dimmability), price per package, and so on.

The paper presents results by store type and by lamp style (e.g., reflectors, a-lamps) and also compares LED characteristics with those for other lamp types (such as compact fluorescent and incandescent) to highlight the relative presence and pricing of these products in California retail stores. For stores in the "big box" category (large home improvement, mass merchandise, and membership clubs), the authors compare the Fall 2011 results from shelf surveys conducted in 2009. This comparison reveals the relative availability, diversity, and pricing of LED lamps in California over the past few years. The paper also draws on secondary data to provide context and further support for the research findings.

Introduction

The paper draws primarily on data from 184 lighting retail store shelf surveys conducted during Fall 2011. Field researchers conducted shelf inventories in eight retail store types (discount, drug, grocery, small hardware, lighting & electronics, [1] large home improvement, mass merchandise, and membership clubs) throughout California's three investor-owned utility (IOU) service territories, including 46 surveys from San Diego Gas & Electric, 70 from Pacific Gas & Electric and 68 from Southern California Edison. Researchers collected information on a wide range of screw-base, pin-base, and GU-base lamp types, including details regarding lamp style, base type, manufacturer, model number, special features (such as dimmability), and price per package.

[1] Results from the lighting & electronics channel could not be included in the analysis because a major California lighting store chain refused to allow researchers into their stores to conduct shelf surveys. Without data from this important chain, results would not have been representative of the overall lighting and electronics channel.

The paper presents results by store type and by lamp style (e.g., reflectors, a-lamps) and also compares LED characteristics with those for other lamp types (such as compact fluorescent and incandescent) to highlight the relative presence and pricing of these products in California retail stores. For stores in the "big box" category (large home improvement, mass merchandise, and membership clubs), the authors compare the 2011 results from shelf surveys conducted in 2009. This comparison reveals the relative availability, diversity, and pricing of LED lamps in California over the past few years. The paper also draws on secondary data to provide context and further support for the research findings.

Methods

This section of the paper describes the DNV KEMA team's definitions for lamp categories; sampling approach; procedures for data collection and analysis; disposition of completed shelf surveys; and comparisons with shelf survey data from previous studies.

Lamp Category Definitions

The tables in this report present data on advanced and non-advanced lamps. Medium screw-base (MSB) lamps include numerous discrete MSB lamp classifications (such as "high-wattage CFLs" and "reflector/flood" CFLs") and as such, a unique lamp cannot be placed into more than one lamp category; for instance, a lamp cannot be classified in both "high-wattage CFLs" and "reflector/flood" categories, but must be in either one category or the other. These discrete lamp classifications are collapsed into nine major lamp groups:

1. **High-wattage MSB CFLs**, non-dimmable, single-wattage CFLs of all styles (spiral, reflector, etc.) that are greater than 30 watts;
2. **Specialty MSB CFLs**: Dimmable, which include all dimmable CFLs;
3. **Specialty MSB CFLs:** 3-way, which include all 3-way CFLs (i.e., CFLs with 3 wattage levels, such as 13/23/32 watt lamps),
4. **Other advanced MSB CFLs,** which include non-dimmable, single wattage CFLs that are less than or equal to 30 watts that are not basic spiral CFLs (e.g., single-wattage non-dimmable reflector CFLs that are less than or equal to 30 watts);
5. **Non-MSB CFLs,** which include candelabra base CFLs, candelabra base CFLs with an MSB adaptor, large base CFLs, GU-base CFLs, and pin-base CFLs;
6. **LEDs,** which include light-emitting diode (LED) lamps (all base types and lamp styles);
7. **Cold Cathodes,** which represented a very small part of the total lamp inventory;
8. **Hybrid CFL LEDs,** which are lamps that can be switched between a CFL general lighting function and an LED nightlight function; and
9. **Non-Advanced Lamp Types,** which includes three subcategories:
   (a) Basic CFLs, which includes non-dimmable, single wattage bare spiral CFLs that are less than or equal to 30 watts;
   (b) Incandescent/halogen lamps, which includes all incandescent and halogen lamp styles; and
   (c) Other lamp types, which primarily includes high intensity discharge (HID) lamps.

Lamps in the first eight groups above are all considered "advanced lamps," while the ninth group ("non-advanced lamp types") includes all non-advanced lamps. This distinction is important, as it supports differentiation between lamps included in the IOUs' Advanced Lamp subprogram (which largely includes advanced CFLs during the 2010-2012 period) and the IOUs' Basic Lamp subprogram (which is comprised by Basic CFLs during the 2010-2012 period).

Sampling

For the Fall 2011 shelf surveys, researchers attempted to represent all retail stores selling lighting products in California. In the prior rounds of shelf surveys (conducted in 2008 and 2009), researchers attempted to represent stores that participated in the California IOUs' 2006-2008 Upstream Lighting Program (ULP) (KEMA, Inc. 2010).[2] These data provided a useful starting point for the Fall 2011 shelf survey sampling approach .While the distribution of IOU-discounted CFLs shipped during the 2006-2008 ULP period does not necessarily reflect the distribution of total lamp sales in the state of California, the researchers were aware of no other data sources that represent all retail stores *that carry lighting products* in California.[3] In addition, these stores represented the vast majority of California's CFL sales during the 2006-2008 program period: estimates from the 2010 CFL Market Effects Study (Cadmus 2010) suggest that 80% of all CFL sales in California were ULP-discounted CFLs.

Because of the difficulty associated with compiling a sample frame (of all retail stores that carry lighting products in the state), and given the lack of comprehensive lamp sales data for individual stores that sell lighting products in California, DNV KEMA had to base its sampling approach on a set of "key principles" rather than on (for example) developing a simpler approach based on proportional allocation of sample points among store types based on sales. DNV KEMA and the California Public Utilities Commission Energy Division (CPUC ED) acknowledge that this approach is imperfect, but all believed this to be the most appropriate approach given the lack of lamp sales data for California retailers and the lack of a pre-defined sample frame.

As a starting point for the sample frame, DNV KEMA staff compiled a list of unique store locations to which IOU-discounted lamps were shipped during the 2006-2008 and/or the 2010-2011 program periods. The team then applied four key sampling principles, which include:

1. **Ensure enough sample points per channel to enable channel-to-channel comparisons.** As described above, the shelf surveys conducted in 2008 and 2009 utilized a sampling approach in which the number of stores visited per channel (out of the total stores per channel) was roughly proportional to the share of overall IOU-discounted lamp shipments for each channel. This resulted in a small number of sample points for some channels (such as drug and discount) and a large number of sample points for others (such as membership clubs and home improvement stores), making it difficult to compare results across channels. As such, the approach for the Fall 2011 shelf surveys included a

[2] A very small number of shelf surveys were also conducted at non-participating stores during this period.

[3] Third-party sources (such as Dun & Bradstreet) can provide lists of retail stores, but without placing telephone calls to each store location (or a representative sample of locations within each chain for chain stores), there are no designations within the data that enable determination as to whether each store carries light bulbs. The determination was made that purchasing a list of retail stores and placing calls to identify each store as inside or outside of the sample frame was not within the cost parameters for this project.

more balanced distribution of sample points across retail channels within each service territory. The distribution of stores is roughly equal across channels (26 or 27 stores per channel). By targeting a balanced distribution of stores, the team was ensured enough sample points to enable comparison across retail channels.

2. **Target stores that are participating in the IOUs' upstream lighting programs as well as those that are not participating.** As mentioned above, the 2010 CFL Market Effects Study estimated that approximately 80% of CFL sales in 2006-2008 were sold through stores that participated in the ULP. As such, the team determined that 75% of the stores in the Fall 2011 shelf survey sample should be "participating stores" and 25% should be "non-participating stores." Stores that were shipped IOU-discounted lamps during 2010-2011 were considered to be "participating" and all others were considered "non-participating." Researchers gathered key identifying information such as store name, address, city, zip code and telephone number from the Google Maps search engine. After creating the list of stores for all channels within the IOUs, KEMA researchers made phone calls to stores on the nonparticipant list to confirm that these stores currently sell light bulbs. (Stores that do not sell light bulbs were excluded from the sample frame.)
3. **Ensure that both chain stores and independent stores are targeted within each retail channel.** The distribution of sample points for chain and independent stores within each channel was based on the proportion of IOU-discounted lamps shipped to chain stores versus independent stores. Note that the internet research described above also suggests that there are very few independent mass merchandise stores in California.[4]
4. **Balance the need for geographic representativeness with budget and timing constraints.** Similar to the approach used for the 2008 and 2009 shelf surveys, DNV KEMA staff targeted specific geographic regions or "clusters" based on IOU-discounted lamp shipment volume. While other practical considerations constrained the team's ability to select stores in a given region—such as which store types were available in each region and the travel distance between stores—the ultimate selection of sample points attempted to reflect reasonable geographic distribution within each IOU service territory.

These efforts resulted in a sample of stores stratified by the three electric IOU service territories, eight retail store types, chain versus independent designation, and participating versus nonparticipating stores.[5]

Data Collection

[4] It is important to mention here that there are numerous independent "discount stores" in California, which may be combined into a "mass merchandise" category in other jurisdictions.

[5] For a more complete description of the sampling approach and disposition of targeted stores within each of these strata, please refer to DNV KEMA, 2012.

A full-day shelf survey training session was conducted in late August 2011 with a team of six field researchers. The training focused primarily on identifying key lamp characteristics, including product types (e.g., CFLs, LEDs, incandescent/halogens, etc.), lamp shapes (e.g., A-lamps, spiral/twister lamps, globes, etc.), base types (e.g., medium screw base [MSB], candelabra base, GU-type base, etc.), and wattage.

The field research manager developed a list of targeted stores in advance of beginning field research, and assigned geographically clustered groups of stores to each field researcher. Field researchers were able to complete shelf surveys in their assigned stores in the majority of cases. However, occasionally there were impediments to conducting shelf surveys, such as store closures, a store running out of light bulbs, or a store manager refusing to allow a researcher to conduct a shelf survey. If a field researcher was unable to conduct a survey in an assigned store, he or she would call the field research manager to find a replacement store. The protocol for finding replacement stores was to identify another store in the same retail channel in the same geographic area with the same chain/independent and IOU program participation/non-participation status. In most cases, the field research manager was able to identify a suitable replacement store. However, on a few occasions, practical constraints, such as available stores in a given region, caused the field research manager to choose a replacement store that was not exactly equivalent (i.e., the chain/independent or program participation status for the replacement store might have been different than the store in the original sample).

As mentioned above (fn. 1), a major lighting and electronics chain refused to allow our field researchers to conduct shelf surveys in their stores. Given the significance of this chain in the lighting and electronics channel, we made the decision to drop all lighting and electronics stores in the results presented in this report (to avoid skewing the data toward independent versus chain stores in this channel).

Data Entry, Cleaning, and Analysis

Before DNV KEMA staff could analyze data from the Fall 2011 shelf surveys, the following steps were necessary:

1. **Enter Data.** DNV KEMA staff entered data collected on paper shelf survey data collection forms into an electronic database. Once an adequate number of data were entered (roughly 5,000 records), a DNV KEMA staff member helped automate the data entry process by creating a list of commonly occurring model numbers and relevant lamp specifications for those model numbers. From that point on, the electronic database referenced this list of model numbers so that once a staff member entered a model number, key lamp specifications would auto-populate into the database. The data entry staff would then visually verify that the specifications were the same as those written on the paper form and correct any inconsistencies.
2. **Clean the Data.** DNV KEMA analysts reviewed the data being entered into the electronic database at various points in time to identify obvious outliers and irregularities for key lamp specifications such as product type, base type, lamp style, and wattage. These irregularities were the flagged and corrected. In some cases, analysts researched lamp models on the Internet to verify specific lamp specifications. To ensure that the data were clean and consistent, analysts ran key variables in the dataset through standardization procedures. The variables included brand, model number, product type,

base type, lamp type and a handful of other lamp characteristics variables. The procedures ensured that the variables were consistent and that there were no outliers in the database. A DNV KEMA analyst then created a grouping algorithm that was used to identify miscategorized features within groups of lamps with the same brand and model numbers. For lamps that had more than five observations of a specific brand and model number, the characteristics of the lamps were compared, and if there were discrepancies in any particular characteristic, the data was passed to a cleaning algorithm. This algorithm corrected characteristics where more than two-thirds of the observations within the brand and model number group were in agreement with each other, and that characteristic was subsequently applied to the miscategorized values. Overall, this algorithm affected less than 1% of the data.

3. **Identify Lamps in the Advanced/Non-Advanced and Efficient/Non-Efficient Categories.** An additional step in our analysis was to identify which lamps in our database were advanced lamps and which were not advanced lamps (see definitions above). DNV KEMA staff examined information in the database including lamp type, base type, lamp shape, wattage, dimmability, and 3-way capabilities and categorized each database record as advanced or non-advanced. Based on lamp technology (e.g., LED, CFL, incandescent/halogen), DNV KEMA staff also assigned each data base record as "efficient" or "non-efficient."

Comparison to Previous Shelf Stocking Study Results

For stores in the "big box" category (large home improvement, mass merchandise, and membership clubs), researchers were able compare the Fall 2011 results from shelf surveys conducted in 2009. These comparisons were possible because of the relative homogeneity within each store type included in this channel: there are only a few large chains in each store type, and prior research efforts suggest similar lamp stocking patterns within each chain. Sample sizes within these channels in both 2009 and 2011 were reasonably large enough to support the ability to compare data between the two study periods. Such a comparison was not possible for "non big box" stores (drug, grocery, and small hardware) because of their relative heterogeneity compared to big box stores and because sample sizes for these store types were too small in 2009 to represent this diversity.

Table 1. Number of Completed Shelf Surveys in Big Box Stores by Store Type, 2009 and 2011

Big Box Store Type	2009	2011
Large home improvement	14	21
Mass merchandise	11	20
Membership club	9	26
Total	**34**	**67**

Source: DNV KEMA, 2012.

Findings

This section presents results from analyses of the Fall 2011 shelf survey database. Where possible, we present comparisons to the 2009 shelf survey database for a subset of retail chains where possible.

To enable comparison of LED lamp characteristics with those of other lamp types, the paper provides data for LED lamps alongside data for incandescent lamps, basic CFLs (single-wattage non-dimmable bare spiral lamps of less than or equal to 30 Watts), high-intensity discharge (HID) lamps, advanced CFLs (bare spiral CFLs of greater than 30 Watts, CFLs of all lamp shapes other than bare spirals, and all dimmable and/or three-way lamps), hybrid CFL/LED lamps (typically CFLs with small LEDs in the lamp base), and cold cathode lamps.

We first discuss the *availability* of LEDs and other lamp types (percentage of stores carrying lamp types), *diversity* (average number of unique model numbers per store for each lamp type), and average *prices* for LEDs and other lamps types (expressed in average price per lamp).

Availability

In this context, availability refers to the proportion of retail stores that carry LED lamps and other lamp types in California.

By lamp type. Table 2 shows the percentage of stores carrying lamps by lamp type and channel. In this table, the percentages in each cell represent the number of stores in which a particular lamp type was found (by store type) divided by the total number of stores within each retail store type. Key findings include:

- LEDs were present in more than half of all home improvement (92%), mass merchandise (63%), and hardware (56%) stores surveyed. Researchers did not find any LEDs in the discount stores in our sample. Grocery stores had the second lowest percentage of stores carrying LEDs at 15%.
- Basic CFLs were the most commonly carried lamp type across all channels.
- Researchers found incandescent lamps (all styles and base types) in a smaller proportion of stores (84% of stores) than basic CFLs, largely due to the relative absence of incandescent lamps in membership stores (only 19% of membership stores in the sample stocked incandescent lamps in Fall 2011[6]). At least four-fifths of the stores carried incandescent lamps within each of the other retail channels.

Table 2. Percent of Stores Carrying Lamps by Lamp Type and Store Type, 2011

	Store Type							
Lamp Type	**Discount**	**Drug**	**Grocery**	**Hardware**	**Home Improv.**	**Mass Merch.**	**Memb. Club**	**Overall**
Advanced	**56%**	**96%**	**67%**	**100%**	**100%**	**96%**	**96%**	**87%**
Advanced CFL	56%	96%	67%	100%	100%	96%	96%	87%
LED	0%	44%	15%	56%	92%	63%	96%	52%
Hybrid CFL/LED	0%	0%	0%	0%	35%	4%	0%	5%
Cold Cathode	0%	0%	0%	0%	35%	0%	0%	5%

[6] Incidentally, 100% of the incandescent lamps stocked in the membership store channel were EISA-compliant halogens.

Non-Advanced	**100%**	**100%**	**96%**	**100%**	**100%**	**100%**	**100%**	**99%**
Basic CFL	74%	100%	78%	96%	100%	96%	100%	92%
Incand/Halogen	96%	85%	93%	100%	100%	96%	19%	84%
HID	0%	0%	0%	70%	92%	25%	0%	27%
Number of Stores	**27**	**27**	**27**	**27**	**26**	**24**	**26**	**184**

Source: DNV KEMA, 2012a.

By lamp style. Table 3 shows the percentage of stores carrying common lamp styles across three lamp technologies: LEDs, CFLs, and incandescent/halogens. Highlights of findings include:

- Field researchers observed MSB A-lamp LEDs and MSB reflector/flood LEDs in 34% of all stores surveyed (compared to 68% of stores for A-lamp CFLs and 83% of stores for A-lamp incandescents; MSB reflector/flood CFLs were found in 72% of all stores in our sample and reflector/flood incandescents in 68% of stores).
- MSB A-lamp LEDs were found in 85% of all home improvement stores surveyed and MSB reflector/flood LEDs were found in 88% of all home improvement stores surveyed (A-lamp CFLs and incandescent/halogens were found in 100% of all home improvement and mass merchandise stores surveyed).
- MSB globe LEDs were found in 21% of the stores in our sample – mostly in big box stores (except hardware for which 26% of stores carried globe LEDs)
- None of the drug stores in our Fall 2011 sample stocked any of the common LED lamps styles identified in Table 3.

Table 3. Percent of Stores Carrying MSB Lamps by Store Type and Common Lamp Styles, 2011

	Store Type							
Lamp Type	**Discount**	**Drug**	**Grocery**	**Hardware**	**Home Improv.**	**Mass Merch.**	**Memb. Club**	**Overall**
Basic CFLs								
CFL	74%	100%	78%	96%	100%	96%	100%	92%
A-lamp								
LED	0%	0%	15%	22%	85%	25%	92%	34%
CFL	30%	93%	44%	78%	100%	92%	46%	68%
Incand/Halogen	93%	85%	93%	100%	100%	96%	15%	83%
Reflector/Flood								
LED	0%	0%	0%	48%	88%	8%	96%	34%
CFL	22%	93%	33%	96%	100%	71%	88%	72%
Incand/Halogen	48%	85%	59%	96%	100%	83%	4%	68%
Globe								
LED	0%	0%	0%	26%	85%	25%	15%	21%
CFL	15%	74%	22%	74%	96%	83%	92%	65%
Incand/Halogen	70%	85%	48%	89%	100%	71%	0%	66%
Number of Stores	**27**	**27**	**27**	**27**	**26**	**24**	**26**	**184**

Source: DNV KEMA, 2012b.

2009 and 2011 availability comparison. Table 4 compares lamp availability in 2009 and 2011 within the three big box store types – home improvement, mass merchandise, and membership clubs. Key findings follow:

- Lamp penetration was similar in 2009 and 2011 for several lamp types. For example, advanced CFLs were present in 100% of the stores we surveyed within these three retail channels in 2009 and in 99% of these stores in 2011.
- Although our sample sizes are relatively small for these two time periods, penetration of LEDs appears to be somewhat greater in 2011 (88% of stores within these three retail channels) as compared to 2009 (71%). This is increase is likely due to the presence of MSB A-lamp LEDs in 2011 stores, which were not stocked in any of the stores we visited in 2009 (72% of stores in 2011 and 0% of stores in 2009)

Table 4. Percent of Stores Carrying Lamps by Lamp Type and Big Box Store Type, 2009 & 2011

	Big Box Store Type							
	Home Improvement		Mass Merchandise		Membership Club		Overall	
Lamp Type	2009	2011	2009	2011	2009	2011	2009	2011
Advanced	**100%**	**100%**	**100%**	**100%**	**100%**	**96%**	**100%**	**99%**
Advanced CFL	100%	100%	100%	100%	100%	96%	100%	99%
LED	71%	90%	45%	75%	100%	96%	71%	88%
Cold Cathode	21%	43%	0%	0%	0%	0%	9%	13%
Non-Advanced	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Basic CFL	100%	100%	73%	100%	100%	100%	91%	100%
Incand/Halogen	100%	100%	100%	100%	11%	19%	76%	69%
Number of Stores	**14**	**21**	**11**	**20**	**9**	**26**	**34**	**67**

Source: DNV KEMA, 2012a.

Diversity

In this context, diversity refers to the range of products available (base type, lamp style, wattage, etc.) within the various retail store types and California IOU service territories.

By lamp type. During the Fall 2011 shelf surveys, researchers recorded the model number for each package of lamps observed in the sample of stores. By comparing the average number of unique advanced and non-advanced lamp models across retail channels, we get a sense of the diversity of products offered within those channels—which, in turn, helps us understand the range of choices available to the consumer. Table 5 shows model diversity by lamp type in 2011. Important findings include:

- LED lamps averaged 3 unique models per store across all stores in our sample, with the greatest diversity in home improvement (which averaged nearly 14 LED models per store) and the lowest in drug and grocery stores (both with an average of less than one model per store in our sample).

- The retail stores included in our Fall 2011 sample averaged a nearly three times as many unique non-advanced lamp models per store as advanced lamp models (12 and 34 models, respectively).
- Field researchers observed the highest advanced and non-advanced lamp model diversity in home improvement stores (averaging 40 and 88 unique models per store, respectively). Researchers observed the lowest average number of unique advanced lamp models in discount stores and the lowest diversity of non-advanced lamp models in membership clubs (both of which averaged less than one lamp model per store).
- Among advanced lamps, advanced CFLs had the greatest diversity of models available across all store types.

Table 5. Average Number of Unique Lamp Models per Store by Lamp Type and Store Type, 2011

	Store Type							
Lamp Type	**Discount**	**Drug**	**Grocery**	**Hardware**	**Home Improv**	**Mass Merch**	**Member Club**	**Overall**
Advanced	1.2	13.7	4.5	42.5	97.2	33.0	9.2	28.4
Advanced CFL	1.2	13.2	3.7	37.4	64.5	29.0	5.0	21.8
LED	–	0.4	0.8	5.1	32.0	4.0	4.2	6.6
Hybrid CFL/LED	–	–	–	–	0.4	0.0	–	0.1
Cold Cathode	–	–	–	–	0.4	–	–	0.1
Non-Advanced	12.1	71.4	30.7	181.4	234.4	124.3	3.0	93.1
Basic CFL	2.3	14.0	6.0	16.8	33.2	21.5	2.7	13.6
Incand/Halogen	9.8	57.4	24.7	160.6	190.7	102.5	0.3	77.4
HID	–	–	–	4.0	10.5	0.3	–	2.1
Number of Stores	27	27	27	27	26	24	26	184

Source: DNV KEMA, 2012a.

Pricing

Average prices presented in this report are not sales-weighted because lamp sales data by retail channel were not available for the Fall 2011 time period. However, average prices presented in this report are lamp-weighted (i.e., weighted by the number of lamps in stock for a given lamp category), as described below. Analysts calculated average prices for each lamp type category by taking the following steps:

- First, we calculated the price per lamp for each row of data in the shelf survey database by dividing final package price by the number of lamps per package;
- Next, we calculated the total number of lamps for each record in the shelf survey database by multiplying the number of packages by the number of lamps per pack;
- Then, we calculated the total lamp price in each record in the shelf survey database by multiplying the price per lamp by the total number of lamps; and
- Finally, we calculated the average price per lamp for each lamp category type by dividing the sum of all total lamp prices for a given lamp category by the sum of the total number of lamps represented in each lamp category.

By lamp type. Table 6 shows the average price per lamp by lamp type and store type for our 2011 sample. Key findings include:

- Advanced lamps were, on average, $5.78 per lamp compared to $2.11 per lamp for non-advanced lamps across all 184 stores surveyed in Fall 2011.
- The average price per lamp for advanced lamps was highest in home improvement stores ($9.97 per lamp) and lowest in discount stores ($1.09 per lamp) in our sample. For non-advanced lamps, the average price per lamp was highest in drug stores ($2.70 per lamp) and lowest in discount stores ($0.62 per lamp). The high home improvement store pricing can be attributed to the broad range and volume of advanced lamp styles available in this channel (including diversity and volume of LEDs).
- Among advanced lamp types, LEDs had the highest price per lamp across all stores in our sample ($15.67 per lamp) and advanced CFLs had the lowest price per lamp ($3.82 per lamp) compared to other advanced lamp types.

Table 6. Average Price per Lamp by Lamp Type and Store Type, 2011

	Store Type							
Lamp Type	**Discount**	**Drug**	**Grocery**	**Hardware**	**Home Improv**	**Mass Merch**	**Member Club**	**Overall**
Advanced	$1.09	$7.49	$6.74	$7.38	$9.97	$3.60	$4.87	$5.78
Advanced CFL	$1.09	$7.43	$6.50	$6.55	$5.86	$3.45	$2.60	$3.82
LED	–	$11.61	$8.01	$17.95	$26.28	$8.42	$11.91	$15.67
Hybrid CFL/LED	–	–	–	–	$7.33	$7.57	–	$7.34
Cold Cathode	–	–	–	–	$6.26	–	–	$6.26
Non-Advanced	$0.62	$2.70	$1.64	$3.10	$2.27	$2.04	$1.40	$2.11
Basic CFL (≤30W)	$0.83	$3.86	$1.37	$2.38	$2.16	$2.88	$1.40	$1.80
Incand/Halogen	$0.45	$2.44	$1.80	$3.05	$2.13	$1.84	$1.41	$2.15
HID	–	–	–	$19.88	$21.39	$10.97	–	$20.92
Number of Lamps	31,112	16,118	20,008	76,283	277,507	99,362	146,777	667,167

Source: DNV KEMA, 2012a.

By lamp style. In Table 7, we show a comparison of average prices per lamp by lamp type and common lamp styles across all stores in our Fall 2011 sample. Highlights of findings include:

- Across all stores in our 2011 sample, LED MSB A-lamps have the highest average per lamp at $10.53 followed by CFL MSB A-lamps ($3.08 per lamp) and incandescent/halogen MSB A-lamps ($1.16 per lamp).
- In the MSB reflector/flood category, LEDs have the highest average lamp price ($38.28 per lamp) across all stores in our sample, followed by incandescent/halogen MSB reflector/floods ($5.06), and CFL MSB reflector/floods have the lowest average at $3.51 per lamp.
- For candelabra/torpedo shaped MSB lamps, LEDs have the highest average price ($11.87 per lamp), followed by CFL MSB candelabra/torpedo lamps ($5.88 per lamp); incandescent/halogens have the lowest average for this category ($1.45 per lamp).

Table 7. Average Price per Lamp by Lamp Type and Common Lamp Style (All Stores), 2011

Lamp Style	Lamp Type		
	CFL	LED	Incandescent /Halogen
MSB Lamps			
Basic Spiral CFLs (≤30W)	$1.80	–	–
A-lamp	$3.08	$10.53	$1.16
Reflector/Flood	$3.51	$38.28	$5.06
Globe	$2.73	$22.12	$2.12
Candelabra/Torpedo Shape	$5.88	$11.87	$1.45
Dimmable^	$5.62	–	–
3-way	$7.33	–	$2.95
Other MSB*	$1.83	$35.22	$2.83
Non-MSB Lamps			
Candelabra Base	$5.18	$4.95	$1.29
GU Base	$6.39	$22.18	$3.87
Pin Base	$6.98	$18.24	$4.32
Candelabra Base w/MSB Adaptor	$2.65	$6.12	$5.99
Other Base Types†	$17.44	$12.54	$5.33
Number of Lamps	**300,634**	**24,807**	**339,030**

Source: DNV KEMA, 2012a.

* "Other MSB" includes tube shape, bug lights, night lights, and circline bulbs.

^We assume that all LEDs and incandescent/halogen lamps are dimmable

† "Other Base Types" includes large base and wedge base bulbs.

2009 and 2011 Lamp Price Comparison. Table 9 compares lamp availability in 2009 and 2011 within the three big box store types – home improvement, mass merchandise, and membership clubs. Key findings follow:

- Within the three big box channels included in our samples in 2009 and 2011, advanced lamp prices increased by more than a dollar per lamp in this timeframe ($4.61 per lamp in 2009 and $5.75 per lamp in 2011)– likely a result of the greater variety and quantity of LED lamps in these channels in 2011. Average prices for non-advanced lamps remained stable between 2009 and 2001 in these channels.
- The average price of LEDs across all stores in our sample rose from $9.36 per lamp in 2009 to $15.66 per lamp. Again, this is likely due to the greater diversity of LED products available in these three retail channels in 2011 compared to 2009
- The average price for advanced CFLs across all stores in our sample dropped by roughly 70 cents per lamp ($4.27 per lamp in 2009 and $3.58 per lamp in 2011).

Table 8. Average Price per Lamp by Lamp Type and Big Box Store Type, 2009 & 2011

	Big Box Store Type							
	Home Improvement		Mass Merchandise		Membership Club		Overall	
Lamp Type	2009	2011	2009	2011	2009	2011	2009	2011
Advanced	**$6.55**	**$10.69**	**$4.10**	**$3.60**	**$3.95**	**$4.87**	**$4.61**	**$5.75**
Advanced CFL	$5.89	$6.10	$4.05	$3.45	$3.10	$2.60	$4.27	$3.58
LED	$24.29	$27.12	$8.95	$8.42	$7.20	$11.91	$9.36	$15.66
Cold Cathode	$6.65	$6.26	–	–	–	–	$6.65	$6.26
Non-Advanced	**$2.21**	**$2.24**	**$1.75**	**$2.04**	**$1.42**	**$1.40**	**$2.00**	**$2.03**
Basic CFL	$2.64	$2.13	$2.16	$2.90	$1.43	$1.40	$1.97	$1.81
Incand/Halogen	$2.13	$2.10	$1.61	$1.84	$1.16	$1.41	$2.01	$2.03
Number of Lamps	**147,084**	**255,074**	**74,032**	**98,789**	**46,137**	**146,777**	**267,253**	**500,640**

Source: DNV KEMA, 2012a.

Summary of Findings and Conclusion

Below we summarize the main findings described above with respect to the availability, diversity, and price of LEDs and other lamps.

- LED lamps (mostly reflectors and A-lamps) were present in more than half of the stores we visited overall, and more than 90% of home improvement stores and membership clubs carried LEDs in 2011.
- The percentage of stores carrying LEDs was somewhat greater in 2011 (88% of stores within these three retail channels) as compared to 2009 (71%). This is increase is likely due to the presence of MSB A-lamp LEDs in Fall 2011 stores, which were not stocked in any of the stores we visited in 2009.
- LED lamps averaged approximately 7 unique models per store across all stores in our sample, with the greatest diversity in home improvement (which averaged over 30 LED models per store) and the lowest in drug and grocery stores (both with an average of less than one model per store in our sample).
- Among advanced lamps, advanced CFLs had the greatest diversity of models available across all store types.
- LED lamps averaged roughly $4.50 to $35.00 more per lamp than CFLs for the common MSB lamp styles, with the greatest price gap for reflector/flood styles and the smallest for candelabra/torpedo styles.
- Within the three big box channels included in our samples in 2009 and 2011, advanced lamp prices increased by more than a dollar per lamp in this timeframe – likely a result of the greater variety and quantity of LED lamps in these channels in 2011. Average prices for non-advanced lamps remained stable between 2009 and 2001 in these channels.

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